

THURSDAY, DECEMBER 31, 1874

GALTON'S "ENGLISH MEN OF SCIENCE"

English Men of Science; their Nature and Nurture.

By Francis Galton, F.R.S., author of "Hereditary Genius," &c. (London: Macmillan and Co., 1874.)

IT would be difficult to overrate the exact and scientific spirit in which Mr. Galton proceeds with his investigation into the origin of genius and the antecedents of successful promoters of science.

The work of M. de Candolle upon the history of two hundred scientific men who have lived during the two last centuries appears to have suggested the character of the present work in some degree. But Mr. Galton has attacked the problem in a novel manner, by going directly to men living in the present day, and presenting a series of questions as to their parents, characters, and education. He began by carefully selecting a list of scientific men, which, though not intended in any way to be exhaustive, should at least not include any but those who have shown true ability. For this purpose he adopted election to the Royal Society, since the method of election was reformed, as the first test; and out of the considerable number of such Fellows he next selected those who had earned a medal for scientific work, had presided over a learned society or section of the British Association, had been on the Council of the Royal Society, or, finally, had acted as professors in some important college or university.

The list thus framed was found to contain 180 names. Incidentally Mr. Galton inquires what fraction this number forms of the total number of scientific men living in the United Kingdom and possessing the same general scientific status. By various tests he arrives at the conclusion that the total number would be three hundred, and he estimates that their proportion to the male population of the same ages would be about that of one in ten thousand. Of course Mr. Galton must be aware that his definition of scientific men is purely arbitrary, and that the circumscribing line might have been drawn more or less strictly, and made to include almost any number.

For the purposes in view, however, Mr. Galton's procedure must be considered perfectly satisfactory. To every one of the 180 men he forwarded elaborate printed forms, covering seven large quarto pages, and containing an immense number of minute inquiries. Each man was requested to state his parentage and descent, the religious opinions, occupations, birthplace, political party, health, stature, complexion, temperament, size of head, and a great many other particular facts concerning both his parents and himself. Inquiries were also made regarding his brothers and sisters, and their salient characteristics. The numbers and principal achievements of more distant relatives, grandparents, uncles and aunts, cousins, nephews, and nieces were also to be stated. Finally, the mode and duration of education of the scientific man himself was to be described, and the causes of success of which he was conscious were to be analysed.

In order to estimate the degree of intensity of characteristics, Mr. Galton devised a very ingenious and highly scientific method of class notation, founded on the law

of error or divergence from a mean. This method was employed in his work on "Hereditary Genius," and was also described in his lecture before the Royal Institution in 1874. Instead of saying that a person's memory was remarkable, or prodigious, or moderate, or poor, the answerer was to attempt to define with some numerical precision the proportion which persons of each degree of memory bore to the whole population, by assigning him to one or other of certain defined classes. If such definite answers could have been obtained, the theory of probability could have been directly applied and the amount of the influence of heredity mathematically investigated. Such a method would constitute a distinct advance in statistical inquiry. Unfortunately, few definite answers of the kind seem to have been received, and this branch of the inquiry had for the present to be abandoned.

When we consider the elaborate and careful manner in which Mr. Galton conducted his investigation, it is difficult not to feel some slight disappointment at the results as stated in this volume. The book is certainly one of very great interest and not devoid of amusing points; but it seems to me to fail in establishing many truths in a definite manner. Not a few of the results derived were known beforehand almost as accurately as they are proved by the contents of this volume. We learn, for instance, that scientific ability is undoubtedly hereditary in some degree. Now, I should hold that such a proposition needs no new proof. It was sufficiently established in Mr. Galton's former work, and he seems as if he were always combating the objections of some imaginary opponents. I am not aware that anyone in the present day ever denies the hereditary character of personal peculiarities. Hardly is the infant ushered into the world than the nurse and the admiring relatives begin to discover the features of the father, or mother, or uncles, or aunts. Mr. Galton writes as if he were making a discovery whenever he attributes the character of a man to his descent. He says: "I have numerous returns, in which the writer analyses his own nature and confidently ascribes different parts of it to different ancestors. One correspondent has ingeniously written out his natural characteristics in red, blue, and black inks, according to their origin—a method by which its anatomy is displayed at a glance." I should have thought, however, that there was nothing novel in such analysis. Every family of intelligence must frequently have discussed the descent of characteristics, features, or diseases. We cannot hear that a youth has turned out badly without inquiring into the way in which the bad strain came into the family. What we really want are accurate estimates of the comparative power of heredity and education in shaping the character, and such results we hardly obtain.

Mr. Galton gives, indeed, the number of notable relatives of each grade which scientific men on the average possess. Thus, 100 scientific men have 28 notable fathers, 36 brothers, 20 grandfathers, and 40 uncles. It is curious that this series of numbers closely corresponds to what Mr. Galton obtained with regard to divines in his former work; but the falling off in the ability as we proceed from a distinguished scientific man to his distant relatives is less rapid, compared with his previous results, as the

distance of the kinship increases. The influence of the paternal and maternal lines is found to be approximately equal. Thus, 100 scientific men have 34 distinguished relatives on the paternal side, and 37 on the maternal side.

The greater part of Mr. Galton's present work consists of a discussion concerning the mental characteristics and education of scientific men and their parents, and it is full of interesting particulars. We have many returns showing that the energy, both bodily and mental, of these men, is above the average in their own opinion. Not a few correspondents describe with evident pleasure their feats of strength:—

"Travelling almost continually from 1846 up to the present time. Restless. All life accustomed to extremely rough travel: often months without house or tent." "Strong when young—walked many a time fifty miles a day without fatigue, and kept up five miles an hour for three or four hours." "At the age of twenty-six, during fourteen days, was only three hours per night in bed, and on two of the nights was up all night." "I seem to possess the same unweariedness as my father, and find myself trotting in the streets as my father used to do." "At the age of sixty made a tour, chiefly pedestrian, of four weeks in the Alps. . . . *Æt.* 67, grouse shooting and deer stalking."

Such are a few of the very abundant statements showing that great power of work is a general characteristic of successful scientific men. Forty-two instances are adduced of energy above the medium, and only two men complain of the want of energy. It may perhaps be objected that such results hardly tell us more than we might have expected to hold true of any group of remarkable men. As a general rule men do not become eminent in the eyes of their contemporaries until they have lived a good long life, and done a considerable amount of work. I do not find that Mr. Galton gives us the average age of his correspondents, but half of them are stated to be between fifty and sixty-five years old, and many who speak of their great energy are very old men. If we inquired into the energy and power of work of all the Lord Chancellors or Attorney-Generals, we should doubtless find it very high, simply because a man cannot be a successful lawyer unless he can stand much work. We get from such inquiries, so far as I can see, no estimate of the comparative influence of quality and quantity of work. *Ceteris paribus*, the great worker has the odds in his favour if he can live and work long enough. Where, however, is the account of those who fall out and perish on the way? Where, too, is the account of the energetic men who, finding their first efforts in science less esteemed than they expected, devote their energies to some other career? When Mr. Galton proceeds, as I am glad to infer that he is doing, to investigate the antecedents of other classes of distinguished men, he will doubtless find that successful physicians are also men of great energy; but where is the estimate of that subtle tendency which leads the energy into scientific study rather than practical life?

Perhaps the most interesting and immediately important part of the book is that in which Mr. Galton discusses the education of his selected men, and their own remarks as to its excellence or defects. We find that thirty-two men complain of a narrow education. Several

of them make very strong remarks on the loss of time in classical studies:—"Enormous time devoted to Latin and Greek, with which languages I am not conversant." "Omission of almost everything useful and good, except being taught to read. Latin! Latin! Latin!" "Latin through Latin—nonsense verses." "In an otherwise well balanced education, three years . . . were spent on Latin and Greek—a blank waste of time." Many complain of the want of mathematical training, and others deplore the omission of natural science. Two or three, on the other hand, think that a too exclusively mathematical training at Cambridge was injurious to them. There is, in fact, a very strong concurrence of opinion in favour of a varied education. Out of eighty-seven answers, ten distinctly praise the width, and thirty-two deplore the narrowness of their training, while others of the answers more or less imply a similar view.

This result seems to me of great importance as regards the vexed question of the London University Matriculation Examination. It is commonly objected that the University expects candidates to get up an impossible, or at least injurious, number of subjects—dead and living languages, history, mathematics, physical science, applied mathematics. The whole circle of the sciences and arts has to be studied in one style or another by the luckless candidate of sixteen years of age, before the University will admit him to have a place in its books. But if our object is to produce conspicuously useful men, Mr. Galton's book supplies strong evidence that this wide range of study is approved by those who look back upon their early education. We must remember, too, that even those who condemn the devotion of time to Latin or Greek form no fair specimen of people in general. Conspicuous ability in one direction is not unfrequently conjoined with inaptitude for other studies. If Mr. Galton interrogates eminent scholars, he is hardly likely to find the same severe condemnation of grammar. Moreover, much depends upon the way in which languages are taught. The mere grammar-school method of drilling grammar into the mind by rote may repel those who would be deeply interested by a more scientific method of teaching.

Language is rapidly becoming one of the most extensive and instructive fields for strictly scientific investigation. We can never too strongly and frequently protest against the evident tendency to interpret science as meaning *physical science*, whereas in the immediate future, if not in the present day, there are wider and more important fields for the application of scientific method in human than in external nature.

Some of those who are so strongly advocating the efficacy of physical science would do well to take note of the fact that few of Mr. Galton's picked men advocate study of physical sciences at all in a conspicuous way. Judicious mathematical training and a rational mode of teaching modern languages are advocated almost equally with the sciences of observation.

"Omission of mathematics, German, and drawing." "Want of education of faculties of observation; want of mathematics and of modern languages." "Neglect of many subjects for the attainment of one or two." "Want of the modern languages and of chemistry." "Want of logical and mathematical training." In these

and many other replies too long to quote, the correspondents carefully couple two or more branches of study together in their recommendations. Very few complain that their education was too general and desultory, and one of these adds that it nevertheless "gave wide interest." It is worthy of notice that a large proportion of those who praise their education were brought up in Scotland.

The conclusions which Mr. Galton adopts as to the best course of education according to the opinion of his correspondents are as follows:—"To teach a few congenial and useful things very thoroughly, to encourage curiosity concerning as wide a range of subjects as possible, and not to over-teach." This nearly coincides with the saying attributed to De Morgan, that a good education consists in teaching "everything of something, and something of everything." But when Mr. Galton describes the best curriculum as compounded of mathematics, logic, observation, theory and experiment in at least one branch of science, accurate drawing, and mechanical manipulation, he seems to underrate the degree in which the study of modern languages was advocated. Mr. Galton would leave these languages to be picked up in the vacation "in the easiest and swiftest manner, with the sole object of enabling the learners to read ordinary books in them." There are, I think, very few boys who would learn any but their native tongue in this way. Most people will hold that languages should be substituted for mechanical manipulation in the school course, and that a boy may safely be left to teach himself carpentering, or other mechanical pursuits, if he only be supplied with a good set of tools.

It is of course impossible adequately to notice, in the limits of an article, the contents of a book which is far more interesting in its details than in its general conclusions. I should have liked to discuss Mr. Galton's investigation of the "origin of taste for science" in his correspondents. We find that a considerable preponderance of men believe that they had an innate taste or tendency towards science. No less than fifty-nine of them make distinct statements to this effect. In other cases, fortunate accidents, opportunities, professional influences, encouragement at home, the influence of teachers or friends, are mentioned as the determining or contributing causes. The reader who carefully studies the interesting answers elicited by Mr. Galton will probably agree with him that they are reliable as far as they go, but it is impossible to suppose that they allow of a real analysis of the causes of scientific taste and zeal. As Mr. Galton remarks, the *fortunate* accidents referred to by some correspondents will generally indicate the previous existence of a tendency, for similar accidents are continually happening to thousands of other persons without any similar effects. Are there not multitudes, again, encouraged by their parents, friends, or teachers, incited by the prospect of pecuniary advantage, or otherwise influenced towards science, who nevertheless do not yield, or, if yielding, never attain great success? A further great difficulty consists in distinguishing between the origin of great general ability and the circumstances which throw that ability into a particular groove of study. One correspondent says that his taste for botany is not innate. "I trace the origin of my botanical tastes to leisure; to

the accidental receipt of De Candolle's '*Flore française*' whilst resident in that country; and to encouragement from my mother." These accidental circumstances may have bent the twig, but was there not a vigorous hereditary power of growth which enabled that twig to develop itself?

In some cases it may well be doubted whether a correspondent has not mistaken the effect of imitation and friendly encouragement for innate tendency. One geologist writes as follows:—"Decidedly innate as regards coins and fossils. My father and an aunt collected coins and geological specimens, and I have both coins and specimens which have been in my possession since I was nine years old." He apparently thinks that the love of fossils and coins was an hereditary instinct, which would be a truly remarkable instance of heredity. But is it not much more likely that the instinct was that collecting instinct so strongly manifested among the youth of the present day as regards postage-stamps, and which seems to be a kind of abnormal development of the love of property which has been growing in the human race for several thousands of years? The passion for collecting often leads to the study of the objects collected, as is testified by several correspondents; and in this particular case there must have been a further influence in the examples of the father and aunt.

An objection which may be in some degree urged against Mr. Galton's results is the insufficient number of instances which can be adduced in any one branch of science. Granting that one hundred cases is enough for the drawing of an average, we must yet remember that the hundred include men of such different pursuits as abstract mathematicians, naturalists, botanists, practical chemists, statisticians. The kind of intellectual power which makes a man eminent in one branch may be very different from what is most conducive to eminence in another branch. Mathematical power is probably much more a gift of nature than interest in statistics. In treating the origin of taste for science Mr. Galton does classify his correspondents according to the branches of science recognised in the sections of the British Association, but in regard to education he makes no such division. Now, if the division be made, the instances in most of the branches become too few to give a satisfactory average; whereas if the division be not made, it may be objected that we are averaging results which are not drawn from a uniform basis. The correspondents who supplied answers capable of being utilised did not much exceed one hundred, which is really too small a number when spread over nine different regions of science. The body of scientific men can hardly be considered so homogeneous as would be an equal number of artists, or musicians, or engineers, or bankers of eminence.

The interest and value of Mr. Galton's results would have been much greater had we similar results concerning other groups of men to compare with them. The inquiry ought, in fact, to have been conducted on the differential method, and directed to disclose the peculiarities of scientific men as contrasted with men in general, or with widely different groups. The labour of the inquiry must have been great as it is, and it may seem a heartless thing to say that Mr. Galton should have made it many times greater. But there would have been many advantages in

collecting the fresh and unbiassed opinions of eminent men in many walks of life, not only of artists, musicians, engineers, but eminent lawyers, judges, administrators, scholars, divines. No doubt it is possible that some of these classes would have failed to appreciate the necessity for answering the queries addressed to them, and the answers might have proved scanty; but, if obtained, the comparison must have afforded most interesting results.

Though I have spoken of Mr. Galton's conclusions as being in some degree disappointing, it ought not for a moment to be supposed that they are not worth the trouble incurred by the investigator and his correspondents. It is the extreme difficulty of the problem attacked which makes Mr. Galton's efforts seem less successful than some might have expected. The origin of genius or conspicuous success is the last thing which will be explained in the long progress of science. All that ought to have been expected was that Mr. Galton might form some comparative estimate of the several component tendencies which usually contribute to its production. If we look to practical conclusions, the inferences to be drawn from the answers concerning education are alone worth all the labour spent upon the book. The fact that about a hundred of the leading scientific men of the day are mostly in favour of a wide and varied range of studies in the school and college curriculum, seems to me a conclusion of great significance.

W. STANLEY JEVONS

GREEN'S "HISTORY OF THE ENGLISH PEOPLE."

A Short History of the English People. By J. R. Green, M.A., Examiner in the School of Modern History, Oxford. With Maps and Tables. (London: Macmillan and Co., 1874.)

WE deem this work to come within the province of a scientific journal for two reasons:—First, Mr. Green, so far as we know, is the first who, throwing aside with just contempt the "drum and trumpet" method of writing history, has attempted to trace the various influences or forces that have combined to mould the English people and make them what they are at the present day; second, because he has noticed in detail certain important episodes in the history of English science. The only work we know of that approaches in plan the history of Mr. Green is Knight's "Pictorial History of England;" but it is only on the surface that any resemblance exists. Knight's history is divided into sections, each of which deals with one of the various ways in which English energy has found scope—in politics and war, in literature and science, in commerce, agriculture, religion, and social life; but no attempt whatever is made to show the result of the combined influence of the forces acting and reacting through these departments on the English people as a whole. In reality, the distinction drawn between these various spheres of human energy is as arbitrary as the distinction between ancient and modern history; one might as well attempt to show the resultant of any number of physical forces, by attending separately to the action of each, without paying any heed to their action in combination. Mr. Green deserves all the credit due to the originator of a bold and happy idea, and still greater

credit for having worked out this idea with marvellous success. His history he calls a "short" one, but in the space of his 800 pages we venture to say he conveys a fuller and juster idea of the progress of the English nation than any previous author has done; nay, in very few instances has the whole life of any one period been more clearly and adequately set forth than will be found to be the case in these pages.

"At the risk," Mr. Green says in his preface, "of sacrificing much that was interesting and attractive in itself, and which the constant usage of our historians has made familiar to English readers, I have preferred to pass lightly and briefly over the details of foreign wars and diplomacies, the personal adventures of kings and nobles, the pomp of courts, or the intrigues of favourites, and to dwell at length on the incidents of that constitutional, intellectual, and social advance in which we read the history of the nation itself. . . . I have restored to their place among the achievements of Englishmen, the 'Faerie Queen' and the 'Novum Organum.' I have set Shakspeare among the heroes of the Elizabethan age, and placed the scientific inquiries of the Royal Society side by side with the victories of the New Model."

Mr. Green begins his history in "Old England," as he happily calls Sleswick, the fatherland of the English people; and with charming clearness and simplicity and well-sustained enthusiasm, traces step by step their ever-widening development from the time the original conquering colonists landed in Kent down to the present century. Mr. Green's power of discovering and bringing into bold relief the true causes of events, and of exhibiting in few and telling words the real characters of the multitude of actors that have played their busy parts on the restless stage of English history, is rare. We can only repeat that his work is the only existing history of England that has been written on anything like scientific principles.

Throughout his work Mr. Green gives prominence to the intellectual development of the people; in an interesting section on the Universities, in chap. iv. (1215—1217), in connection with the origin and growth of Oxford, a masterly sketch is given of the life and work of Roger Bacon, and the premature birth of English scientific research. Again, in a chapter on "the Revolution," a more detailed and thoroughly intelligent account is given of the scientific work of Francis Bacon, and of the "Beginnings of English Science," including the birth of the Royal Society. These sketches show that Mr. Green has not only mastered his authorities, but is also perfectly competent to trace the various stages by which science has attained its present all-important position. And, as the world progresses, historians of this class will be more and more in demand, for if things hold on in their present course, it will become more and more clearly recognised that the only satisfactory history of a people is the history of the growth of science, in its widest sense, among that people.

As an example of Mr. Green's method and style, we quote the paragraph, in connection with Francis Bacon, on the "Beginnings of English Science":—

"It was this lofty conception of the position and destiny of natural science which Bacon was the first to impress upon mankind at large. The age was one in which knowledge, as we have seen, was passing to fields of inquiry which had till then been unknown, in which Kepler and Galileo were creating modern astronomy, in